Chapter 4
Quality Assurance/Quality Control Activities

This section discusses the quality control and quality assurance activities performed to ensure that the data collected during this test program were of known and acceptable quality (see Table 4-1). Additionally, the data collected during these activities and conclusions derived from the data are assessed to ensure that conclusions are made with respect to the program specific quality objectives. The goals for this work assignment are:

- Develop uncontrolled and controlled PM-10 emission factors for watering of unpaved scraper travel routs.

- Determine the PM-2.5 fraction of the PM-10 emissions from scraper travel routes, with and without watering.

- Determine mud/dirt trackout rates from uncontrolled, unpaved soil surfaces onto a paved roadway

- Determine mud/dirt trackout rates after application of each control measure.

To achieve these goals, Data Quality Objectives were established for the wind speed, the concentration measurements, and the silt load. Each of the DQO control parameters is described in the following section.

Quality Control

In order to ensure the quality of the work being performed, procedures were established to control critical processes that would allow assessment of the data with respect to the Data Quality Objectives. The control of the test activities in the field was established in the test plans that governed the positioning of the sampling array, the movement and operating parameters of the construction equipment. By monitoring the meteorological conditions and adjusting the field activities accordingly, the acceptability of the sampling activity in meeting the wind speed and direction objective was maintained and the integrity of the sample data was ensured.

The quality control activities for the sampling media and field measurement are defined as either critical or non-critical (see Table 4-2). To ensure that the data collected are of known quality, the sampling media were prepared in accordance with the quality control requirements given in Table 2-4 of the QA Plan (Appendix B). In addition, the sampling equipment was calibrated for the collection of critical data prior to acquiring the field data. The calibration requirements for the sampling equipment and miscellaneous instrumentation are given in QA Plan (Appendix B, Tables 2-5 and 2-6, respectively).

During the review of the quality control data and calibration documentation, the critical calibration measurements were found to be documented and to meet the quality control objectives. The sampling media were weighed and audited as required prior to use in the field.

Table 4-1. Data Quality Objectives

Measurement	Method	Accuracy (%)	Precision (%)	Completeness (%)
PM-10 emission factor	Mass flux profiling	_[a]	± 45[b]	_[c]
PM-10 concentration	High volume samplers	± 10[d]	± 40[e]	³ 90
PM-2.5 concentration	High volume cascade impaction	± 15[f]	± 50[e]	³ 90
Wind speed	Gill anemometer	± 10[g]	± 10[h]	³ 90[i]
Wind direction	R. M. Young wind station	± 10[g]	_	³ 90[i]
Filter weights	Analytical balance	± 10[j]	± 10[k]	100
Moisture content	Weight loss upon drying	± 10[j]	± 10[l]	_[m]
Silt Content	Dry sieving	± 10[j]	± 10[l]	_[m]
Silt Loading	Vacuum sampling of road surface	_[n]	± 50[o]	_[p]

[a] Because the emission factor is calculated from particle concentrations and wind speed, the approach taken here is to set goals for the component measurements.
[b] Refers to the range percent of replicate measurements made of uncontrolled conditions. See discussion in text.
[c] At least one set of replicate measurements will be conducted for scrapers traveling over uncontrolled surface.
[d] Based on audit of volumetric flow controller.
[e] Based on range percent of co-located samplers. At least one test with co-located samplers will be conducted for the uncontrolled transit tests.
[f] Based on pre- and post-test settings of flow rate.
[g] Based on calibration with manufacturer-recommended device.
[h] Based on pre- and post-test co-locations of both unit in a steady air flow.
[i] Refers to percentage of time during testing that wind lies within acceptable range of 3 to 30 mph and ±45° from perpendicular to linear path of moving point source.
[j] Based on Class S calibration weights.
[k] Based on independent audit weights.
[l] Based on independent analysis of a riffle-split sample.
[m] At least one sample from each test site will be riffle split for duplicate analysis. (This assumes that at least one paved road sample obtained has a mass ≥ 800 g).
[n] Because silt loading is calculated, the approach taken here is to set goals for the component measurements.
[o] Refers to percent range of embedded co-located paved road surface loading samples.
[p] At least one embedded co-located sample will be collected.

Data Audit

The data collected during the field activities and the emission factor calculations were audited as required by the QA Unit. The data were evaluated with respect to the

measurement objectives as presented in the QA plan. The majority of the data audited for these activities met the data quality objectives presented in Table 4-1.

Data Assessment

In assessing the data generated on this work assignment, the quality control process and results were validated with respect to the DQO. The technical staff conducted an internal assessment of the overall data quality generated during this work assignment. In addition, an independent external assessment of the program was conducted by the QA Officer. These assessments were performed in accordance with the requirements cited in the Site Specific Test Plan and the QA Plan.

Three of the four DQOs were accomplished through activities during the field exercise; verification was by work assignment personnel. The first DQO was the wind speed that was verified to be between 3 and 20 mph during the sampling process using a calibrated Gill anemometer. Next, the wind direction was checked using an R. M. Young wind station to ensure that it was less than 45^{o} from the perpendicular to the moving point source. In meeting the requirements of the third DQO, field personnel manually recorded the number of vehicular passes and the speed (100 ft per time). When the field activity included the use of water to reduce the dust emissions, the number of passes to distribute water and the rate (speed per distance) at which the truck traveled were recorded.

The final DQO requirement for ensuring the quality of the results was the concentration factor. The concentration factor included the sampling rate (m^3/min) using calibrated samplers, sampling media, silt load (mass per unit area) by sieving, and soil moisture. The data assessment included a review of the calibration data, media preparation, sample collection data, and sample analysis. The validation included the accuracy and precision data generated by the calibration procedures and results obtained from split (silt load) and co-located samples.

The assessment of the results and documentation found that the data generated for this report were traceable, of known quality, and supportive of the conclusions cited in this report. The field test activities, the results, and the conclusions cited herein were found to validate the Data Quality Objectives as presented in the scope of the work assignment.

Table 4-2. Critical and Non-Critical Measurements for Emission Factors

Measurements	Comments
Critical	
• Filter weights • Sampler flow rates • Wind speed	These three variables are used to calculate the mass flux over the plume area and the emission factor.
• Volume of earth moved • Number of scraper passes	These measurements are necessary to normalize the mass flux and obtain an emission factor. The scraper count will be tallied during the test by individual equipment ID. The total volume will be determined by multiplying the count for an individual unit by its manufacturer-rated capacity.
Non-critical	
• Elapsed time	Even though this quantity is needed to determine concentrations, its effect is multiplied out in determining the emission factor. Furthermore, in determining PM-2.5 to PM-10 ratios, only the relative filter catches are necessary.
• Pressure drop across filter • Barometric pressure • Ambient temperature	These three variables are used to determine the sampling rate for a high-volume sampler equipped with a volumetric flow controller (VFC). However, flow rate varies only slightly over the possibly encountered range of each variable.
• Wind direction • Horizontal wind speed	These variables are of interest primarily to ensure that conditions are suitable for testing. In this way, the measurements are useful for operational decisions but do not affect the calculated emission factor.
• Moisture content • Silt content	These measurements deal with the earthen material being handled. They do not affect the calculated emission factor.